Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

R314
cop. 2

CROPS RESEARCH

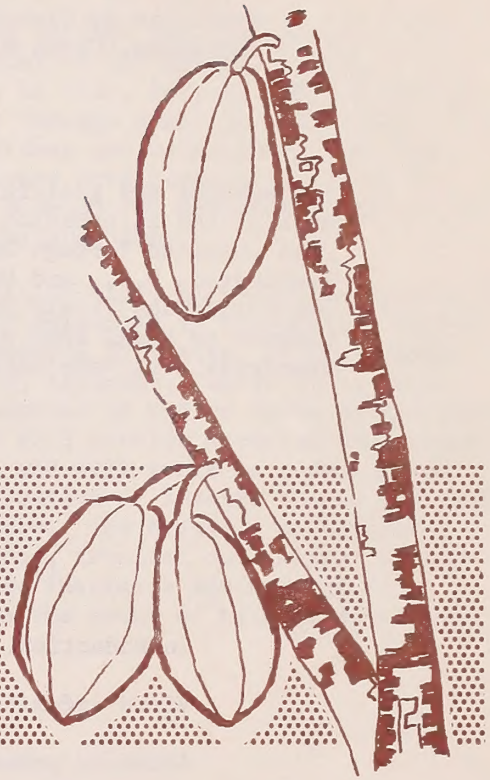
ARS 34-37-4
March 1967

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

JUN 30 1967

CURRENT SERIAL RECORDS

U.S. Department of Agriculture
CACAO CLONE COLLECTION



Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

PREFACE

The purpose of this publication is to provide a brief description of the cacao clones being held at the U.S. Plant Introduction Station, Miami, Fla. This information should be of value to cacao workers who are in need of disease-free, documented clonal stock. The material is available in small quantities for research purposes. Requests sent to the Miami station will be honored on an availability basis. It is not intended to duplicate in any way the more complete catalog being published by the Instituto Interamericano de Ciencias Agricolas (IICA) de la Organizacion Estados Americanos, Turrialba, Costa Rica.

ACKNOWLEDGMENT

The authors are grateful to Jorge Soria V., IICA, Turrialba, Costa Rica, who furnished much of the information for this publication. Many of the clones in the collection were also obtained through Dr. Soria's efforts. E. P. Imle, American Cocoa Research Institute, Washington, D.C., and USDA collaborator, provided invaluable assistance in contributing to the collection itself by recommending clones for inclusion in it and personally carrying budwood to Miami from other countries. Credit is also due those institutions in other countries that have contributed to the collection.

CONTENTS

	Page
Introduction	3
Virus indexing program	4
Indexing procedure	4
Cultural and sanitary practices	5
Identification of cacao clones	6
Background data for selected clones	8
Selected references	26

U.S. DEPARTMENT OF AGRICULTURE CACAO CLONE COLLECTION

By H. H. Fisher,[1/] P. K. Soderholm,[1/] and R. P. Kahn[2/]

INTRODUCTION

In 1954, the Foreign Operations Administration, a predecessor organization of the Agency for International Development (AID), formulated a special agreement with the Agricultural Research Service (ARS) of the United States Department of Agriculture (USDA) "...to provide continuing technical assistance facilities and coordination for the securing, propagation, maintenance, packing, inspection, and shipping of plant and seed materials for experimental use in other countries...." Within the ARS, the New Crops Research Branch of the Crops Research Division (present designation) was named to implement this agreement. Among the specific activities outlined, one was to "...assemble, maintain in quarantine, and distribute, living research collections of crops, such as coffee, cacao and rubber...."

The U.S. Plant Introduction Station, Miami, Fla., was chosen for the location of a germ-plasm collection of cacao because it is isolated from commercial cacao producing areas and cacao relatives. It is conveniently located for the movement of propagating material by air transportation. The collection, begun in 1955, includes 220 accessions assembled largely through exchange with other countries. The clones are maintained under controlled phytosanitary conditions as a source of small amounts of budwood for cooperating countries with cacao breeding programs.

A secondary collection, with similar quarantine controls, has been assembled in cooperation with the American Cacao Research Institute, at the Federal Experiment Station, Mayaguez, Puerto Rico. This collection will consist of one to three mature trees of each clone and will provide material for continued breeding research and will serve as a source for large-scale distribution of special clones not easily procurable elsewhere. The Mayaguez collection provides an isolated, tropical counterpart to the Miami collection as insurance against loss of valuable clones in the event of natural disasters.

1/ Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture.

2/ Plant Quarantine Division, Agricultural Research Service, U.S. Department of Agriculture.

VIRUS INDEXING PROGRAM

Cacao investigators originally believed that careful selection of material for inclusion in collections, combined with periodic inspections, and a regular pest and pathogen control program would assure reliably disease-free stocks for distribution. However, with the detection of cacao viruses in widely separated cacao producing areas, such international bodies as the Food and Agriculture Organization and the Inter-American Cacao Conference have called for the imposition of stringent quarantine measures to govern the international movement of cacao breeding stocks. To meet these recommendations, the plants already in the collection have been indexed for swollen shoot virus. New material must undergo virus screening at the U.S. Plant Introduction Station at Glenn Dale, Md., or in isolation at the Miami station, before it may be included in the collections.

To initiate the virus indexing program, the Crops Research Division enlisted the assistance of R. P. Kahn, virologist, Plant Quarantine Division, to set up the quarantine procedures under which the clonal collections would be maintained and to make periodic inspections and recommendations.

INDEXING PROCEDURES

A desirable feature of the virus indexing procedure is that the indicator stock be forced to express symptoms of a virus that might be present in the clone (scion) either above or below the point of union of the scion with the stock. For some unexplained reason, the conventional patch-bud graft is unsuccessful at the Glenn Dale, Md., station and only limited success can be achieved at the Miami, Fla., station. Consequently, Soderholm and Shaw (31)[3/] developed a modified side graft technique which is highly successful in establishing the clone on the stock. This calls for a variation in the indexing procedure recommended by T. W. Tinsley of the West African Cocoa Research Institute. The procedure currently used at the U.S. Plant Introduction Stations consists of three steps:

(a) Side-graft the clone onto an Amelonado (indicator) seedling grown from seed from virus-free trees.

(b) Observe flushes of Amelonado growth for 6 to 12 months.

(c) Bud-graft Amelonado onto grown-out clone scion and observe Amelonado scion for symptoms.

3/ Underlined numbers in parentheses refer to the Selected References at end of publication.

If the budwood is of too large caliper to fit the stock on hand for side grafting, the patch-bud is used. Twenty-one days after patch-budding, the stock is bent above the union to force the scion bud. This precludes observation of foliage on the stock for virus symptoms above the union until the scion is large enough to be grafted with Amelonado. The length of time required to index a clone for virus symptoms is largely dependent upon how rapidly flushes of indicator growth can be induced both above and below the union of the clone-scion with the stock.

CULTURAL AND SANITARY PRACTICES

In the beginning, viruslike symptoms produced by nutritional deficiencies complicated the indexing program. This situation is most likely to occur in a lathhouse where the plants are grown in containers and the necessarily frequent watering tends to leach the soil. Frequent applications of soluble fertilizer eliminate the deficiencies and facilitate the release of the clones from quarantine. Rigid adherence to a spray program assures the control of fungi and insects. It is particularly important to control mealy bugs, which can be virus vectors, and ants, which can transport mealy bugs.

The initial grafting and subsequent manipulation of the stock and scion are done in an isolated lathhouse or greenhouse. When the material indexes negatively for virus, it is released from quarantine and moved to a distant outdoor area for propagation and continued observation. It is from the latter area that propagating material is taken for distribution.

IDENTIFICATION OF CACAO CLONES

[? = uncertain]

Clone	Significance	Country	Originator
APA	Amazonico Palmira	Colombia	- - -
CC	Cacao Center	Costa Rica	Soria and Paredes.
Catongo	Catongo	Brazil	- - -
DR	Djati Roenggo	Indonesia	- - -
EET	Estacion Experimental Tropical, Pichilinque	Ecuador	Varios.
G	Getas ?	Indonesia ?	- - -
GA	Grand Anse Bay	Haiti	B. de Verteuil.
GS	Granada Selection	Granada	Cope.
GW	- - -	Netherlands	Wageningen.
ICS	Imperial College Selections	Trinidad	Pound.
IMC	Iquitos Maranon Clones ?	Amazonia, Peru	Do.
Lafi	Lafi	Samoa	Jones.
M	- - -	Indonesia	Wageningen.
P (suffix)	- - -	Mexico	Muguerza.
Pa	Parinari	Amazonia, Peru	Pound.

Clone	Significance	Country	Originator
Pound or P.	Pound	Amazonia, Peru	Pound.
R	Rosario-Izapa	Mexico	Spencer and Del Arco.
S	- - -	Netherlands	Wageningen.
SC	Seleccion Colombia	Colombia	- - -
SCA	Scavina	Ecuador	Pound.
SGU	Seleccion Guatemala	Guatemala	Anleu.
SIAL	Selecao Instituto Agronomico Lesto	Brazil	Magalhaes.
SIC	Selecao Instituto de Cacao	Do.	- - -
Silecia	Hacienda Silecia	Ecuador	Desrosiers and Doak.
SM	?	Brazil	?
SNK	Station N'Koemvone	Cameroon	- - -
SPA	Seleccion Palmira	Colombia	- - -
TSAN	Trinidad Selection	Trinidad	Freeman.
TSH	Trinidad Selection, Hybrid	Do.	Do.
UF	United Fruit Co.	Costa Rica	Grieve and Bowman.

BACKGROUND DATA FOR SELECTED CLONES

Clone	PI No.[1/]	Source	Year	Description	Origin
APA 4	315233	IICA, Turrialba, Costa Rica.	1964	Amelonado, medium, greenish red.	Amazonas, Colombia.
APA 5	315234	- - -do- - -	1964	Amelonado, medium, greenish white.	Do.
C 40	307747	WACRI, Ibadan, Nigeria.	1965	- - -	Ghana.
CC 9	315236	IICA, Turrialba, Costa Rica.	1964	Cundeamor, green. Pod index 12.1. Beans small, purple.	Costa Rica.
CC 10	315237	- - -do- - -	1964	Angoleta, green. Pod index 7.3. Beans large, purple.	Do.
CC 17	315238	- - -do- - -	1964	Amelonado, green. Pod index 7.2.	Do.
CC 18	315239	- - -do- - -	1963 -64	Amelonado, green. Pod index 5.0. Beans large, purple.	Do.
CC 39	315240	- - -do- - -	1963	Amelonado, greenish white. Pod index 10.6. Beans small, purple. Promising clone.	Do.
CC 40	315241	- - -do- - -	1962	Pure Amelonado, green. Pod index 11.0. Beans small, purple. Self-incompatible.	Do.
CC 41	315242	- - -do- - -	1962	Amelonado, green. Pod index 14.4. Beans small, purple.	Do.
CC 45	315243	- - -do- - -	1963	Cundeamor, small, red. Pod index 14.5. Beans small, purple. Fair clone.	Do.
CC 49	315244	- - -do- - -	1963	Amelonado, green. Pod index 11.3. Beans small, purple.	Do.

1/ USDA Plant Introduction number.

Clone	PI No.	Source	Year	Description	Origin
CC 54	315245	IICA, Turrialba, Costa Rica.	1962	Angoleta, large, red. Beans large. Self-compatible.	Costa Rica.
CC 56	315246	- - -do- - -	1963	Cundeamor, red. Beans large.	Do.
CC 57	315247	- - -do- - -	1963	Angoleta, red. Beans large.	Do.
CC 60	315248	- - -do- - -	1963	Angoleta, red. Beans large. Self-compatible.	Do.
CC 67	315249	- - -do- - -	1963	Angoleta, green. Beans large.	Do.
CC 71	315250	- - -do- - -	1963	Cundeamor, green. Pod index 10.2. Beans large.	Do.
Catongo	315227	Cacao Experiment Station, Itabuna, Bahia, Brazil.	1964	Possible mutation of a Forestero. Beans white. Av. yield wet cacao 2.53 kilos. From mother tree.	Brazil.
DR 1	315274	Estacion Experimental Tropical, Pichilingue, Ecuador.	1963	Very susceptible to witches'-broom.	Indonesia.
DR 2	315326	Tropische Landbouw Plantenteelt, Wageningen, Holland.	1962	Very susceptible to witches'-broom.	Do.
DR 38	315275	- - -do- - -	1962	- - -	Do.
DR 1 X DR 38	315327	- - -do- - -	1962	- - -	Do.
EET 12	315276	Estacion Experimental Tropical Pichilingue, Ecuador.	1963	Venezuelan Criollo. Selection C-2, Tr 886 Colombia.	Colombia.
EET 19	315277	- - -do- - -	1958	Venezuelan yellow. Pod index 7.6. Av. dry weight of seed 1.7 g. Self-compatible.	Ecuador.
EET 40	315278	- - -do- - -	1963	Nacional x Venezuelan yellow. Excellent yield.	Do.

Clone	PI No.	Source	Year	Description	Origin
EET 48	257003	Estacion Experimental Tropical, Guayaquil, Ecuador.	1958	Venezuelan yellow. Pod index 8.4. Av. dry weight of seed 1.5 g. Self-compatible.	Ecuador.
EET 53	315279	- - -do- - -	1963	Nacional.	Do.
EET 54	315280	Estacion Experimental Tropical, Pichilingue, Ecuador.	1963	Venezuelan yellow.	Do.
EET 59	275673	- - -do- - -	1960	Nacional. Excellent yield.	Do.
EET 62	315281	- - -do- - -	1963	Venezuelan yellow. Pod index 8.8. Av. dry weight of seed 1.5 g. Self-compatible.	Do.
EET 64	275669	Estacion Experimental Tropical, Guayaquil, Ecuador.	1960	Venezuelan yellow. Pod index 9.3. Av. dry weight of seed 1.3 g.	Do.
EET 67	315282	Estacion Experimental Tropical, Pichilingue, Ecuador.	1963	Venezuelan yellow.	Do.
EET 72	315283	- - -do- - -	1963	- - -do- - -	Do.
EET 75	315284	- - -do- - -	1963	Venezuelan yellow x Venezuelan purple.	Do.
EET 80	315285	- - -do- - -	1962	Venezuelan yellow.	Do.
EET 94	315286	- - -do- - -	1963	Venezuelan yellow. Excellent yield.	Do.
EET 95	315287	- - -do- - -	1963	Yellow. Pod index 9.5. Av. dry weight of seed 1.4 g.	Do.
EET 96	257005	- - -do- - -	1958	Venezuelan yellow. Pod index 7.5. Av. dry weight of seed 1.6 g. Susceptible to witches'-broom. Excellent yield. Self-compatible.	Do.

Clone	PI No.	Source	Year	Description	Origin
EET 103	315288	Estacion Experimental Tropical, Pichilingue, Ecuador.	1963	Nacional x Venezuelan yellow. Pod index 9.0. Av. dry weight of seed 1.3 g. Susceptible to witches'-broom.	Ecuador.
EET 134	315289	- - -do- - -	1962	Venezuelan purple.	Do.
EET 156	275674	- - -do- - -	1961	Nacional x Venezuelan purple. Pod index 7.3. Av. dry weight of seed 1.5 g.	Do.
EET 162	315290	- - -do- - -	1962	Pod index 8.4. Av. dry weight of seed 1.4 g. Excellent yield.	Do.
EET 164	315291	- - -do- - -	1962	Nacional x Venezuelan yellow.	Do.
EET 228	315292	- - -do- - -	1963	- - -do- - -	Do.
EET 236	275675	- - -do- - -	1961	Venezuelan yellow.	Do.
EET 250	275670	Estacion Experimental Tropical, Guayaquil, Ecuador.	1960	Venezuelan yellow. Pod index 10.4. Av. dry weight of seed 1.5 g.	Do.
EET 261	275671	- - -do- - -	1960	Venezuelan yellow. Resistant to witches'-broom.	Brazil.
EET 283	315293	Estacion Experimental Tropical, Pichilingue, Ecuador.	1962	Venezuelan yellow.	Ecuador.
EET 333	315294	- - -do- - -	1963	Resistant to witches'-broom. Self-incompatible.	Do.
EET 353	315295	- - -do- - -	1963	- - -do- - -	Do.
EET 364	315296	- - -do- - -	1962	- - -	Do.
EET 376	315297	- - -do- - -	1962	Hybrid 1831.	Do.
EET 377	275666	- - -do- - -	1959	Hybrid 1832.	Do.

Clone	PI No.	Source	Year	Description	Origin
EET 381	315298	Estacion Experimental Tropical, Pichilingue, Ecuador.	1962	Hybrid 1970.	Ecuador.
EET 390	315299	Estacion Experimental Tropical, Guayaquil, Ecuador.	1960	Venezuelan yellow. Pod index 10.4. Av. dry weight of seed 1.5 g.	Do.
EET 392	275667	Estacion Experimental Tropical, Pichilingue, Ecuador.	1959	Silecia 1 X SCA 6. Pod index 6.8. Yellow. Av. dry weight of seed 1.5 g. Highly resistant to witches'-broom.	Do.
EET 395	315300	- - -do- - -	1963	Resistant to witches'-broom. Self-incompatible.	Do.
EET 397	275668	- - -do- - -	1959	Open-pollinated seedling of a Venezuelan purple. Pod index 6.7 at 9 years of age. Some resistance to witches'-broom.	Do.
EET 399	315301	- - -do- - -	1963	Open-pollinated seedling of Silecia 1. Some resistance to witches'-broom.	Do.
EET 400	315302	- - -do- - -	1963	- - -do- - -	Do.
EET 401	275672	- - -do- - -	1963	- - -	Do.
G 8	315303	- - -do- - -	1963	Tolerant to witches'-broom.	Indonesia.
GA 11	315323	Haitian-American Development Organization Cooperative Agriculture Program, Port au Prince.	1962	Grand Anse 11. Cotyledon white.	Haiti.
GS 7	315314	Mt. Horne Cacao Station, St. Andrews, Grenada.	1962	Grenada Selection 7.	Grenada, BWI.
GS 17	256997	- - -do- - -	1958	- - -	Do.

Clone	PI No.	Source	Year	Description	Origin
GS 29	243038	Central Experiment Station, Trinidad.	1957	High yielding (up to 6,360 lb. dry cocoa per acre in small test trials).	Grenada, BWI.
GS 36	243039	- - -do- - -	1957	Pod index 8.6. Good yield in Trinidad (up to 4,720 lb. dry cocoa per acre in small test trials).	Do.
GS 50	256999	Mt. Horne Cocoa Station, St. Andrews, Grenada.	1958	- - -	Do.
GS 78	257000	- - -do- - -	1958	- - -	Do.
GW 1	315328	Tropische Landbouw Plantenteelt, Wageningen, Holland.	1962	Selection from G x DR made at Wageningen, Holland.	Netherlands New Guinea.
ICS 1	234540	Federal Experiment Station, Mayaguez, Puerto Rico.	1956	Trinitario. Pod index in Ecuador 9.7. Av. dry weight of seed 1.3 g. Weak flavor. High yielding. Some resistance to witches'-broom. Susceptible to *Ceratostomella fimbriata* (*Cerotocystis fimbriata*). Self-compatible.	Trinidad.
ICS 6	234534	- - -do- - -	1956	Trinitario. Pod index in Ecuador 5.8. Av. dry weight of seed 1.9 g. High yielding. Some resistance to *Ceratostomella fimbriata*. Resistant to witches'-broom. Self-compatible.	Do.
ICS 8	315315	Los Brillantes Experiment Station, Retalheleu, Guatemala.	1962	Trinitario. Beans large. Excellent parent clone. High yielding. Susceptible to witches'-broom. Self-compatible, fairly homozygous.	Do.
ICS 29	315252	IICA, Turrialba, Costa Rica.	1963	- - -	Do.
ICS 32	243027	Central Experiment Station, Trinidad.	1957	Trinitario. Susceptible to witches'-broom. Self-compatible.	Do.

Clone	PI No.	Source	Year	Description	Origin
ICS 39	243028	Central Experiment Station, Trinidad.	1957	Criollo, strong. Vigorous clone. High yielding. Susceptible to *Ceratostomella fimbriata* and witches'-broom. Self-sterile.	Trinidad.
ICS 40	243029	- - -do- - -	1957	Criollo, strong. Vigorous clone. High yielding. Susceptible to *Ceratostomella fimbriata* and witches'-broom. Self-sterile.	Do.
ICS 43	243030	- - -do- - -	1957	Criollo. Vigorous clone. High yielding. Susceptible to witches'-broom. Self-sterile.	Do.
ICS 44	243031	- - -do- - -	1957	Trinitario. Some resistance to witches'-broom.	Do.
ICS 45	234535	Federal Experiment Station, Mayaguez, Puerto Rico.	1956	Trinitario. Susceptible to witches'-broom.	Do.
ICS 47	243032	Central Experiment Station, Trinidad.	1957	Criollo. High yielding. Roots easily. Some resistance to witches'-broom. Self-incompatible.	Do.
ICS 53	243033	- - -do- - -	1957	Trinitario. Susceptible to witches'-broom.	Do.
ICS 56	235589	Instituto Agronomico do l'Este, Itabuna, Bahia, Brazil.	1956	- - -	Do.
ICS 60	243034	Central Experiment Station, Trinidad.	1957	Criollo, strong. Vigorous clone. High yielding. Susceptible to *Ceratostomella fimbriata* and witches'-broom.	Do.
ICS 84	243036	- - -do- - -	1957	Trinitario. Susceptible to witches'-broom. Self-sterile.	Do.
ICS 89	234537	Federal Experiment Station, Mayaguez, Puerto Rico.	1956	Trinitario. Beans average. High yielding. Slow growing clone. Susceptible to witches'-broom. Self-incompatible.	Do.
ICS 91	234538	- - -do- - -	1956	Trinitario. Resistant to witches'-broom.	Do.

Clone	PI No.	Source	Year	Description	Origin
ICS 95	234539	Federal Experiment Station, Mayaguez, Puerto Rico.	1956	Trinitario. High yielding. Said to have a maple flavor. Resistant to *Ceratostomella fimbriata* and witches'-broom. Self-compatible.	Trinidad.
ICS 98	315334	- - -do- - -	1956	Trinitario. Excellent parent. Resistant to witches'-broom. Self-compatible.	Do.
ICS 100	315253	IICA, Turrialba, Costa Rica.	1963	Criollo. Tolerant to witches'-broom.	Do.
IMC 67	243037	Central Experiment Station, Trinidad.	1957	Amelonado. Vigorous clone. High yielding. Roots easily. Resistant to *Ceratostomella fimbriata* and witches'-broom.	Peru.
Lafi 7	257001	Royal Botanic Gardens, Kew, Surrey, England.	1958	Said to be resistant to *Phytopthora palmivora*.	Samoa.
M 4	315329	Tropische Landbouw Plantenteelt, Wageningen, Holland.	1962	- - -	West Irian, Indonesia.
M 9	315330	- - -do- - -	1962	- - -	Indonesia.
8 P	241185	Rubber-Cacao Station, Cuyontenango, Suchitepeques, Guatemala.	1957	Trinitario. Mother tree yield was over 7 kg. dried beans per year.	Mexico.
10 P	241186	- - -do- - -	1957	- - -do- - -	Do.
21 P	241201	- - -do- - -	1957	Trinitario. Mother tree yield under 6 kg.	Do.
22 P	241187	- - -do- - -	1957	Trinitario. Mother tree yield was over 7 kg. dried beans per year.	Do.
23 P	241188	- - -do- - -	1957	- - -do- - -	Do.
43 P	241189	- - -do- - -	1957	- - -do- - -	Do.

Clone	PI No.	Source	Year	Description	Origin
PA 5	315305	Royal Botanic Gardens, Kew, Surrey, England.	1964	- - -	- - -
PA 13	315324	Haitian-American Development Organization Cooperative Agriculture Program, Port au Prince.	1962	- - -	- - -
PA 15	315306	Royal Botanic Gardens, Kew, Surrey, England.	1964	- - -	- - -
PA 16	315307	- - -do- - -	- - -	- - -	- - -
PA 41	315308	- - -do- - -	- - -	- - -	- - -
PA 44	315309	- - -do- - -	1964	- - -	- - -
PA 81	315215	Estacion Experimental Agricola, Palmira, Colombia.	1963	- - -	Amazonia.
PA 121	243040	Central Experiment Station, Trinidad.	1957	High yielder. Resistant to *Ceratostomella fimbriata* and witches'-broom.	Do.
PA 150	315325	Ministry of Agriculture, Jamaica.	1962	High yielder. Some resistance to witches'-broom.	Do.
PA 169	243041	Central Experiment Station, Trinidad.	1957	High yielder.	Do.
Pound 7	234582	Estacion Experimental Agricola, Tingo Maria, Peru.	1955	Amelonado, large, greenish white, slightly warty. Beans medium, purple.	Amazonas, Peru.
Pound 11	315336	Imperial College of Tropical Agriculture, Trinidad.	1963	- - -	Do.

Clone	PI No.	Source	Year	Description	Origin
Pound 12	234583	Estacion Experimental Agricola, Tingo Maria, Peru.	1955	Amelonado. Resistant to *Ceratostomella fimbriata*.	Amazonas, Peru.
Pound 19	315311	Royal Botanic Gardens, Kew, Surrey, England.	1964	- - -	Amazonia.
Pound 20	315312	- - -do- - -	- - -	- - -	Do.
Pound 32	315313	- - -do- - -	- - -	- - -	Do.
2 R	241190	Rubber-Cacao Station, Cuyontenango, Suchitepeques, Guatemala.	1957	Cundeamor, greenish white. Beans violet. Mother tree yield was over 6 kg. dried beans per year (number of years unknown). Second highest yield of R clones in collection at Turrialba, Costa Rica.	Mexico.
6 R	241175	- - -do- - -	1957	Cundeamor, rose. Beans violet. Mother tree yield over 8 kg. dried beans per year.	Do.
8 R	241184	- - -do- - -	1957	Mother tree yield over 7 kg.	Do.
9 R	243023	- - -do- - -	1957	Angoleta, green. Mother tree yield over 10 kg.	Do.
10 R	241178	- - -do- - -	1957	Cundeamor, greenish white. Mother tree yield over 7 kg.	Do.
13 R	241194	- - -do- - -	1957	Cundeamor. Mother tree yield over 6 kg.	Do.
15 R	241173	- - -do- - -	1957	Cundeamor, greenish white. Mother tree yield over 8 kg. Fourth highest yield of R clones in collection at Turrialba, Costa Rica.	Do.
19 R	241180	- - -do- - -	1957	Angoleta, greenish white. Mother tree yield over 7 kg.	Do.
23 R	241176	- - -do- - -	1957	Cundeamor, greenish white. Mother tree yield over 8 kg.	Do.

Clone	PI No.	Source	Year	Description	Origin
24 R	241193	Rubber-Cacao Station, Cuyontenango, Suchitepeques, Guatemala.	1957	Cundeamor, greenish white. Mother tree yield over 6 kg.	Mexico.
30 R	241195	- - -do- - -	1957	Cundeamor, greenish white. Mother tree yield over 6 kg.	Do.
34 R	315316	Los Brillantes Experiment Station, Retalheleu, Guatemala.	1961	Mother tree yield over 6 kg.	Do.
39 R	241197	Rubber-Cacao Station, Cuyontenango, Suchitepeques, Guatemala.	1957	Cundeamor, greenish white. Mother tree yield over 6 kg.	Do.
41 R	241200	- - -do- - -	1957	Cundeamor, greenish white. Mother tree yield less than 6 kg. Highest yield of R clones in collection in Costa Rica.	Do.
44 R	241192	- - -do- - -	1957	Cundeamor, reddish green. Mother tree yield over 6 kg.	Do.
48 R	241199	- - -do- - -	1957	Angoleta, red. Mother tree yield is under 6 kg.	Do.
52 R	243024	- - -do- - -	1957	Greenish white. Mother tree yield is over 7 kg.	Do.
56 R	241182	- - -do- - -	1957	Angoleta, greenish white. Mother tree yield is over 7 kg.	Do.
71 R	241191	- - -do- - -	1957	Cundeamor, red. Mother tree yield over 6 kg.	Do.
75 R	241169	- - -do- - -	1957	Cundeamor, greenish white. Mother tree yield over 9 kg.	Do.
76 R	241196	- - -do- - -	1957	Angoleta, greenish white. Mother tree yield over 6 kg.	Do.

Clone	PI No.	Source	Year	Description	Origin
88 R	243025	Rubber-Cacao Station, Cuyontenango, Suchitepeques, Guatemala.	1957	Mother tree yield over 6 kg.	Mexico.
100 R	241181	- - -do- - -	1957	Angoleta, green. Mother tree yield over 7 kg.	Do.
101 R	241174	- - -do- - -	1957	Cundeamor, greenish white. Mother tree yield over 8 kg.	Do.
105 R	241177	- - -do- - -	1957	Angoleta, greenish white. Mother tree yield over 8 kg.	Do.
106 R	241170	- - -do- - -	1957	Angoleta, greenish white. Mother tree yield over 9 kg.	Do.
113 R	241179	- - -do- - -	1957	Greenish white. Mother tree yield over 6 kg.	Do.
117 R	241171	- - -do- - -	1957	Reddish white. Mother tree yield over 9 kg. Third highest of R clones in collection at Turrialba, Costa Rica.	Do.
S 52	315331	Tropische Landbouw Plantenteelt, Wageningen, Holland.	1962	- - -	Holland.
SC 5	315216	Estacion Experimental Agricola, Palmira, Colombia.	1963	Angoleta. Good yielder. Self-compatible.	Colombia.
SC 6	315217	- - -do- - -	1963	- - -do- - -	Do.
SC 13	315218	- - -do- - -	1963	- - -do- - -	Do.
SC 24	315219	- - -do- - -	1963	- - -do- - -	Do.
SC 49	315220	- - -do- - -	1963	- - -do- - -	Do.
SC 51	315221	- - -do- - -	1963	- - -do- - -	Do.

Clone	PI No.	Source	Year	Description	Origin
SC 55	315222	Estacion Experimental Agricola, Palmira, Colombia.	1963	Angoleta. Good yielder. Self-compatible.	Colombia.
SCA 6	234541	Trinidad through Federal Experiment Station, Mayaguez, Puerto Rico.	1956	Amelonado. Pod index 12.5. Self-incompatible.	Amazonia.
SCA 9	275676	Estacion Experimental Tropical, Pichilingue, Ecuador.	1961	Pod index 13.0. Some resistance to witches'-broom.	Do.
SCA 11	(No data available).				
SCA 12	243043	Central Experiment Station, Trinidad.	1957	Amelonado. Pod index 13.3. Resistant to witches'-broom. Self-incompatible.	Do.
SGU 3	315317	Servicio Cooperativo Interamericano de Agricultura, Guatemala.	1961	Pod index 12.8.	Guatemala.
SGU 4	315254	IICA, Turrialba, Costa Rica.	1965	- - -	Do.
SGU 26	315255	- - -do- - -	1964	- - -	Do.
SGU 50	315318	- - -do- - -	1961	Pod index 7.5.	Do.
SGU 54	315319	- - -do- - -	1961	Pod index 9.9.	Do.
SGU 60	315256	- - -do- - -	1963	Pod index 7.3.	Do.
SGU 63	315257	- - -do- - -	1963	Pod index 11.4.	Do.
SGU 69	315320	Servicio Cooperativo Interamericano de Agricultura, Guatemala.	1961	Pod index 6.7.	Do.
SGU 71	315321	- - -do- - -	1961	Pod index 7.6.	Do.

Clone	PI No.	Source	Year	Description	Origin
SGU 82	315258	- - -	- - -	- - -	- - -
SGU 89	315322	Servicio Cooperativo Interamericano de Agricultura, Guatemala.	1961	Pod index 8.8.	Guatemala.
SIAL 8	315228	Instituto Agronomico do l'Este, Itabuna, Bahia, Brazil.	1964	- - -	Brazil.
SIAL 42	235587	- - -do- - -	1956	Calabacillo, small, greenish white. Beans purple. Mother tree av. yield for 1954-55 was 4.66 kilos dry beans.	Do.
SIAL 44	235588	- - -do- - -	1956	Cundeamor, medium, green. Mother tree av. yield for 1954-55 was 5.66 kilos dry beans.	Do.
SIAL 56	235589	- - -do- - -	1956	Mother tree yield for 1955 was 8.5 kilos dry beans.	Do.
SIAL 84	315229	- - -do- - -	1964	- - -	Do.
SIAL 93	235590	- - -do- - -	1956	Amelonado, small, greenish white. Beans small, violet. Mother tree av. yield for 1954-55 was 8.39 kilos dry beans.	Do.
SIAL 98	232775	- - -do- - -	1956	Calabacillo. Mother tree av. yield for 1954-55 was 7.03 kilos dry beans.	Do.
SIAL 407	235591	- - -do- - -	1956	Amelonado, small, greenish white. Beans small, purple. Mother tree yield for 1955 was 11.43 kilos dry beans.	Do.
SIAL 070	315230	- - -do- - -	1964	- - -	Do.
SIAL 008	315231	- - -do- - -	1964	- - -	Do.
SIAL 325	315232	- - -do- - -	1964	- - -	Do.

Clone	PI No.	Source	Year	Description	Origin
SIC 1	315259	IICA, Turrialba, Costa Rica.	1964	Amelonado. Highly resistant to *Ceratostomella fimbriata*. Mother tree av. yield for 4 years was 3.85 kilos dry beans. Self-compatible.	Brazil.
SIC 2	234546	Instituto Agronomico do l'Este, Itabuna, Bahia, Brazil.	1956	Amelonado. Low yielding in Trinidad. Mother tree av. yield for 4 years was 9.02 kilos dry beans. Av. number fruits per year -- 230. Self-compatible.	Do.
SIC 3	234547	- - -do- - -	1956	Amelonado. Mother tree av. yield for 4 years was 4.12 kilos dry beans. Av. number fruits per year -- 102. Self-compatible.	Do.
SIC 4	234548	- - -do- - -	1956	Amelonado. Mother tree av. yield for 4 years was 5.19 kilos dry beans. Av. number fruits per year -- 125. Self-compatible.	Do.
SIC 6	234550	- - -do- - -	1956	Amelonado. Mother tree av. yield for 4 years was 3.89 kilos dry beans. Av. number fruits per year -- 107. Self-compatible.	Do.
SIC 7	315260	IICA, Turrialba, Costa Rica.	1964	Amelonado. Mother tree av. yield for 4 years was 3.98 kilos dry beans. Av. number fruits per year -- 108. Self-compatible.	Do.
Silecia 1	315304	Estacion Experimental Tropical, Pichilingue, Ecuador.	1963	Pod index 5.8. Av. weight of dry seed 2.8 g. Resistant to witches'-broom. Self-incompatible.	Ecuador.
SM 2	315332	Tropische Landbouw Plantenteelt, Wageningen, Holland.	1962	- - -	Sao Thome, Brazil.
SNK 12	315333	- - -do- - -	1962	Slightly self-compatible.	Cameroon.
SPA 4	315261	IICA, Turrialba, Costa Rica.	1962	Amelonado, medium, greenish red.	Amazonas, Colombia.
SPA 5	315262	- - -do- - -	1962	Amelonado, medium, green.	Do.

Clone	PI No.	Source	Year	Description	Origin
SPA 7	315263	IICA, Turrialba, Costa Rica.	1962	Amelonado, large, green. Beans small, violet.	Amazonas, Colombia.
SPA 9	315264	- - -do- - -	1962	Amelonado, medium, greenish white. Beans medium, purple. Resistant to *Ceratostomella fimbriata*. Self-compatible.	Do.
SPA 10	315265	- - -do- - -	1962	Amelonado, large, green. Beans medium, violet.	Do.
SPA 11	315266	- - -do- - -	1962	Amelonado, large, greenish white. Beans small, purple.	Do.
SPA 12	315267	- - -do- - -	1962	Amelonado, medium, green. Beans medium, violet.	Do.
SPA 17	315223	Estacion Experimental Agricola, Palmira, Colombia.	1963	- - -	Do.
TSAN 792	315224	- - -do- - -	1963	Trinidad seedling Amazon.	Trinidad.
TSAN 812	315225	- - -do- - -	1963	- - -do- - -	Do.
TSH 565	315226	- - -do- - -	1963	Trinidad selected hybrid no. 565.	Do.
TSH 644	315268	IICA, Turrialba, Costa Rica.	1963	Trinidad selected hybrid no. 644.	Do.
UF 10	256991	- - -do- - -	1958	Angoleta, green. Beans large.	Costa Rica.
UF 11	256992	- - -do- - -	1958	Angoleta, green. Beans large. Self-incompatible.	Do.
UF 12	256993	- - -do- - -	1958	Angoleta, green, warty. Beans large, pale. Easy rooting. Some resistance to *Phytophthora palmivora*. Self-incompatible.	Do.
UF 29	256994	- - -do- - -	1958	Amelonado, medium, green. Beans purple. Tolerant to *Phytophthora palmivora*. Considered resistant to flowery cushion gall.	Do.

Clone	PI No.	Source	Year	Description	Origin
UF 168	256995	IICA, Turrialba, Costa Rica.	1958	Angoleta, green. Beans large, pale. High yielding.	Costa Rica.
UF 221	234553	- - -do- - -	1956	Cundeamor, red. Pod index 9.3. Beans pale. Yield good. Easy rooting. Susceptible to cushion gall in Ecuador, but reported to have moderate resistance in Costa Rica. Self-compatible.	Do.
UF 242	315270	- - -do- - -	1964	Amelonado, green. Resistant to flowery cushion gall. Self-compatible.	Do.
UF 273	315271	- - -do- - -	1964	Amelonado, red. Resistant to flowery cushion gall. Self-compatible.	Do.
UF 613	243013	- - -do- - -	1957	Amelonado, red. Pod index 7.5. Beans purple. High yielding. Difficult rooting. Some resistance to *Phytophthora palmivora*. Susceptible to flowery cushion gall. Self-incompatible.	Do.
UF 650	234542	Costa Rica through Federal Experiment Station, Mayaguez, Puerto Rico.	1956	Angoleta, pink. Pod index 7.8. Beans large, pale, clear. High yielding. Easy rooting. Resistant to black pod. Self-compatible.	Do.
UF 654	315269	IICA, Turrialba, Costa Rica.	1962	Angoleta, pink. Beans large, violet. High yielding.	Do.
UF 654	315335	Costa Rica through Federal Experiment Station, Mayaguez, Puerto Rico.	1963	- - -do- - -	Do.
UF 667	234556	IICA, Turrialba, Costa Rica.	1956	Angoleta, pink, warty. Pod index 8.0. Beans large, pale. Good yield. Easy rooting. Resistant to black pod. Susceptible to cushion gall in Ecuador. Self-incompatible.	Do.

Clone	PI No.	Source	Year	Description	Origin
UF 668	315272	IICA, Turrialba, Costa Rica.	1962	Angoleta, green, warty. Pod index 8.9. Beans large, pale. Good yield. Easy rooting. Susceptible to black pod. Self-compatible.	Costa Rica.
UF 672	315273	- - -do- - -	1962	Angoleta, pink. Beans large, clear.	Do.
UF 676	234544	Costa Rica through Federal Experiment Station, Mayaguez, Puerto Rico.	1956	Angoleta, green. Pod index 10.1. Beans very large, pale. Good yield. Easy rooting. Resistant to black pod. Self-compatible.	Do.
UF 677	243018	IICA, Turrialba, Costa Rica.	1957	Angoleta. Beans very large. Susceptible to *Phytophthora palmivora*. Self-compatible.	Do.
T. cacao	277170	Vicinity Villa Arteaga. Antioquia, Colombia.	1961	Pod green turning yellow, nearly smooth, not furrowed except at bottle-neck base, apex round. Cotyledons dark purple.	Colombia.
T. cacao	277171	- - -do- - -	- - -	Criollo, 20 x 9 cm., very warty, green turning yellowish. Cotyledons white. Tree slender, single trunk, to eight meters.	Do.
T. cacao	277172	Vicinity Puerto Asiz, Putumayo, Colombia.	- - -	Criollo, 25 x 13.5 cm., green turning yellow. Cotyledons white. Tree 5-trunked to 7 m., fruits on trunks and main branches. Resistant to witches'-broom.	Do.

SELECTED REFERENCES

(1) Alvarado, R., Ampuero, E., and Doak, K. D.

1960. Reaccion de diferentes clones y progenies hibridas a la buba o cushion gall del cacao. VIII Inter-American Cacao Conference Proc. [Trinidad] pp. 290-300.

(2) Ampuero, E., and Alvarado, R.

1960. Variacion en resistencia a la escoba de bruja, rendimiento e indice de Mazorca en la progenie hibrida interclonal. VIII Inter-American Cacao Conference Proc. [Trinidad] pp. 174-183. June.

(3) _____ and Desrosiers, R.

1960. Comportamiento en resistencia a la escoba de bruja de los clones Silecia - 1 y 5 Traidos del Oriente Ecuatoriano. VIII Inter-American Cacao Conference Proc. [Trinidad] pp. 156-165. June.

(4) Baker, R. E. D., and Holliday, P.

1957. Witches'-broom disease of cacao. Commonwealth Mycol. Inst. Phytopath. Paper No. 2.

(5) Bartley, B. G.

1958. Observations on the reaction of young cacao seedlings to artificial inoculation by *Marasmius perniciosus* Stahel. Septima Conferencia Inter-Americana de Cacao. pp. 104-117.

(6) _____

1963. Progeny trials. Imp. Col. Trop. Agr. [Trinidad]. Cacao Research Ann. Rpt. pp. 16-28.

(7) Desrosiers, Russell.

1958. El problema de la Ceratostomella en el Ecuador. Septima Conferencia Inter-Americana de Cacao. Palmira, Colombia. pp. 67-70. July.

(8) Enrequez C., Gustava, Gutierrez, Jorge, McLaugalon, Harvey, and Bullard, E. T.

1962. Observaciones preliminares de la variabilidad de algunas caracteristicas en la progenie hibrida de cruces interclonales de cacao. Caribbean Region Amer. Soc. Hort. Sci. Proc. 6. pp. 60-66.

(9) Esquivel, O.

1961. Hybridization. Cacao (IICA) 6 (3): 11.

(10) Fisher, H. H., Haun, J. R., and Ackerman, W. L.

1960. Cacao seedling production and distribution through plant quarantine. Cacao 5 (4): 1-8.

(11) Hardy, Frederick.

1960. Cacao Manual. 395 pp. IICA, Turrialba, Costa Rica.

(12) Holliday, Paul.

1955-56. Further observations on the susceptibility of Imperial College selections to witches'-broom disease. Imp. Col. Trop. Agr. Cacao Research Rpt. pp. 48-53.

(13) Hutchins, L. M.

1960. Varietal susceptibility to cushion gall. Cacao 5 (1): 10.

(14) Imle, E. P., and Shrum, J. E.

1958. Quarantine isolation center for cacao in Florida. Cacao (IICA) 3 (14): 1-5.

(15) Inter-American Institute of Agricultural Science.

1958. Selection, breeding and propagation cacao. In Inter-American Cacao Center Annual Report (IICA, Turrialba), pp. 13-21.

(16) _____

1961. Cacao (IICA, Turrialba) Annual Report for 1 January 1960 - 30 June 1961. In Cacao v. 6, No. 3.

(17) _____

1962. Annual Report, the Cacao Program 1 July 1961 - 30 June 1962. In Cacao v. 7, No. 3.

(18) _____

1963. Cacao Program, Annual Report 1962-1963. In Cacao v. 8, No. 3.

(19) Jolly, A. L.

1957. Clonal yield analysis, 1956-57. Caribbean Commission Report No. 59.

(20) _____ and de Verteuil, L. L.

1960. Clonal and Fertilizer experiments in Trinidad and Tobago. VIII Inter-American Cacao Conference Proc. pp. 390-418. June.

(21) Jones, T. A., and Maliphant, G. K.

1958. High yields in cacao field experiments and their significance in future cacao research. Septima Conferencia Inter-Americana de Cacao. pp. 321-326. July.

(22) Kahn, R. P.

1961-66. Observations of the cacao clone collections at Miami, Florida, and Mayaguez, Puerto Rico. [Unpublished reports.]

(23) Lems, G.

1963. Cacao selection and breeding in Surinam. Agr. Expt. Sta. Paramaribo, Surinam. Bul. 82. pp. 27-37.

(24) _____

1963. Resultaten von een cacao klonen experiment. De Surinaamse Landbouw. v. 4.

(25) Liabeuf, J.

1960. Sur les trovaux de recherches effectues en 1959 a La Station du Cacoyer de N'Koemvone pour la Production des Semences Selectionnes de Cacaoyers. (Cameroun). VIII Inter-American Cacao Conference Proc. pp. 423-426.

(26) Montserin, B. G., de Verteuil, L. L., and Freeman, W. E.

A note on cacao hybridization in Trinidad with reference to clonal selection and hybrid seed. Caribbean Commission Report No. 33.

(27) Müntzing, A.

1958. Disease resistance in field trials with cacao at Hacienda Clementina, Ecuador. Trop. Agr. 35 (4): 276-278.

(28) Murray, D. B.

1963. Clonal introductions. Annual Report on Cacao Research. Imp. Col. Trop. Agr. [Trinidad]. pp. 34-35.

(29) _____

1961. Research on cocoa - prospects for the future. Report of the Cocoa Conference, London. pp. 201-205.

(30) Quensel, V. C.

1961. The practical value of the "aseptic" method of curing cacao. Report of the Cocoa Conference, London. pp. 158-163.

(31) Soderholm, P. K., and Shaw, E. W.

1965. A modified side graft technique for propagating cacao. Caribbean Region Amer. Soc. Hort. Sci. Proc. 9: 25-29.

(32) Soria V., Jorge.

1964-65. Correspondence on file U.S. Plant Introduction Station, Miami, Fla. from IICA, Turrialba, Costa Rica.

(33) _____

1961. Report on a visit to Los Brilliantes Experiment Station, Guatemala. Report No. 143, IICA, Turrialba, Costa Rica.

(34) _____

1961. Anotaciones sobre un viaje a las zonas productoras de cacao en Mexico. IICA, Turrialba, Costa Rica, Informe No. 44-E, 18 pp.

(35) Thresh, J. M.

1960. Quarantine arrangements for intercepting cacao material infected with West African viruses. FAO Plt. Protect. Bul. 8 (8).

(36) Verteuil, L. L. de

1957. Notes on clonal cocoa, Trinidad and Tobago. Caribbean Commission Report No. 57.

(37) _____ Freeman, W. E., and Jolly, A. L.

1957. Notes on performance of cocoa clones. Trinidad and Tobago, 1956-57. Caribbean Commission Report No. 56.

(38) Wood, G. A. R.

1963. Amazon cocoa. Cocoa Growers' Bul. No. 1, pp. 6-10.

(39) _____

1959. Cacao-growing in Venezuela, Colombia & Ecuador with notes on three diseases. Cadbury Brothers, Ltd., Cournville. 52 pp.

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Beltsville, Maryland 20705

Official Business

Postage and Fees Paid
U.S. Department of Agriculture